PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference TS 6336 PCT	**FOR FURTHER ACTION** See Form PCT/IPEA/416	
International application No. PCT/EP2004/050549	International filing date *(day/month/year)* 16.04.2004	Priority date *(day/month/year)* 25.04.2003
International Patent Classification (IPC) or national classification and IPC E21B43/10, B21D39/08, B21D31/04		
Applicant SHELL INTERNATIONAL RESEARCH MAATSCHAPPIJ B.V. et		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 4 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☒	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
24.01.2005	18.02.2005
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Schouten, A Telephone No. +31 70 340-4088

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/050549

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-16 as originally filed

Claims, Numbers

1-22 received on 18.01.2005 with letter of 18.01.2005

Drawings, Sheets

1/7-7/7 as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/050549

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 21-22

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☐ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. are so unclear that no meaningful opinion could be formed *(specify)*:

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 21-22

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form	☐	has not been furnished
	☐	does not comply with the standard
the computer readable form	☐	has not been furnished
	☐	does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☐ See separate sheet for further details

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	12-18,20
	No:	Claims	1-11,19
Inventive step (IS)	Yes:	Claims	12-18,20
	No:	Claims	1-11,19
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

Claims 21 and 22 contain a reference to the drawings. According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 The following documents are referred to in this communication:
D1 : US 2003/075339 A1 (ECHOLS RALPH HARVEY ET AL) 24 April 2003 (2003-04-24)

2 INDEPENDENT CLAIM 1

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of independent claim 1 is not new in the sense of Article 33(2) PCT.

The document D1 discloses in paragraphs 30-32, 41-44 and in Fig. 1 (the references in parentheses applying to this document):

An expander system (100) for radially expanding a tubular element (400) having an unexpanded portion of a first inner diameter, the expander system (100) including an expander (102) movable between a radially retracted mode and a radially expanded mode,

the expander (102 being operable to expand the tubular element (400) from said first inner diameter to a second inner diameter larger than the first inner diameter by movement of the expander (102) trom the radially retracted mode to the radially expanded mode thereof, wherein the expander (102) comprises a contact section (120) of a diameter larger than said first inner diameter when the expander (102) is in the radially retracted mode, and wherein said contact section (120) is arranged to prevent axial movement of the expander (102) through the unexpanded portion of the tubular element (400) when the expander is in the radially retracted mode, characterized in that the expander is arranged in the tubular element, the expander being in the radially retracted mode thereof, and wherein said contact section is in contact with the inner surface of the tubular element so as to prevent axial movement of the expander through the unexpanded portion of the tubular element.

It is noted that by selecting the appropriate size tubular the expander of D1 is suitable for the use as stated in claim 1 (see PCT International Search and Preliminary Examination Guidelines, paragraph 5.21).

3 DEPENDENT CLAIMS 2-19

3.1 Dependent claims 2-11 and 19 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT) for the following reasons:
- Claims 2-11 and 19: see D1 paragraphs 30, 41-44 and Fig. 1 and 4.

3.2 The combination of the features of dependent claims 12-18 are neither known from, nor rendered obvious by, the available prior art.

3 INDEPENDENT CLAIM 20

3.1 Document D1, which is considered to represent the most relevant state of the art, discloses in paragraphs 31, 32, 34, 41, 42 and in Fig. 1 (the references in parenthesis applying to this document):

A method of radially expanding a tubular element using the expander system of any one of claims 1-19 comprising the steps of:
a) arranging the expander within the tubular element;
b) moving the expander from the retracted mode to the expanded mode thereof so as to expand the tubular element;
c) moving the expander from the expanded mode to the retracted mode thereof,

From this, the subject-matter of independent claim 20 differs in that the following steps are subsequently executed:

d) allowing the expander to move axially through the tubular element by the action of an axial force exerted to the expander, until further movement is prevented by virtue of the expander being in the retracted mode and said contact section contacting the inner surface of the tubular element; and
e) repeating steps b)-d) until the expander has expanded the tubular element or a desired portion thereof, from the first diameter to the second diameter.

3.1.1 The subject-matter of claim 20 is therefore novel (Article 33(2) PCT).
The problem to be solved by the present invention may be regarded as:

High forces required to move the expander through the tubular element (see page 2, line 2-7 of the application as filed).

3.1.2 The solution to this problem proposed in claim 20 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

The claimed invention uses an expander body that repeatedly moves between an expanded and a retracted mode while moving axially through the tubular element. The repositioning problem as described on page 2, line 17-19 of the application as filed is solved because further movement is prevented when the expander is in the retracted mode, the expander moves axially through the tubular element, and the contact section then contacts the inner surface of the tubular element.

Re Item VIII

Certain observations on the international application

The application does not meet the requirements of Article 6 PCT, because independent claims 1 and 20 are not clear. The application describes an expander system for expanding borehole tubulars (see for example page 1 of the description), whereas the independent claims claim an expander system in general. Independent claims 1 and 20 are therefore not supported by the description as required by Article 6 PCT, as their scope is broader than justified by the description and drawings.

C L A I M S

1. An expander system for radially expanding a tubular element having an unexpanded portion of a first inner diameter, the expander system including an expander movable between a radially retracted mode and a radially expanded mode, the expander being operable to expand the tubular element from said first inner diameter to a second inner diameter larger than the first inner diameter by movement of the expander from the radially retracted mode to the radially expanded mode thereof, wherein the expander comprises a contact section of a diameter larger than said first inner diameter when the expander is in the radially retracted mode, and wherein said contact section is arranged to prevent axial movement of the expander through the unexpanded portion of the tubular element when the expander is in the radially retracted mode, characterized in that the expander is arranged in the tubular element, the expander being in the radially retracted mode thereof, and wherein said contact section is in contact with the inner surface of the tubular element so as to prevent axial movement of the expander through the unexpanded portion of the tubular element.

2. The expander of claim 1, wherein the expander includes an expansion surface extending in axial direction and being operable to move radially outward so as to expand the tubular element during movement of the expander from the retracted mode to the expanded mode thereof, said expansion surface being of varying diameter in axial direction.

3. The expander system of claim 2, wherein said contact section of the expander has an outer surface coinciding with the expansion surface.

4. The expander system of claim 2 or 3, wherein the diameter of the expansion surface increases continuously in axial direction.

5. The expander system of claim 4, wherein said expansion surface is a tapering surface.

6. The expander system of claim 5, wherein said expansion surface has a frustoconical shape.

7. The expander system of any one of claims 2-6, wherein said expansion surface is arranged to move radially outward in substantially uniform manner along the length thereof during movement of the expander from the retracted mode to the expanded mode thereof.

8. The expander system of any one of claims 1-7, wherein said contact section of the expander has a smallest diameter smaller than said first inner diameter, and a largest diameter larger than said first inner diameter.

9. The expander system of any one of claims 1-8, wherein the expander comprises an expander body including a plurality of body segments spaced along the circumference of the expander body, each segment extending in longitudinal direction of the expander and being movable between a radially retracted position and a radially expanded position.

10. The expander system of claim 9, wherein the expander body is provided with a plurality of longitudinal slots spaced along the circumference of the expander body, each said slot extending between a pair of adjacent body segments.

11. The expander system of claim 9 or 10, wherein each body segment is at both ends thereof integrally formed with the expander body.

12. The expander system of any one of claims 9-11, wherein the expander body is a tubular expander body, and wherein the expander includes an inflatable fluid chamber arranged within the tubular expander body so as to move each body segment radially outward upon inflation of the fluid chamber.

13. The expander system of claim 12, wherein said fluid chamber is formed within an inflatable bladder arranged within the tubular body.

14. The expander system of claim 12 or 13, further including a fluid flow control system for controlling inflow of fluid into the fluid chamber and / or outflow of fluid from the fluid chamber.

15. The expander system of claim 14, wherein the fluid flow control system is arranged to control said fluid inflow and said fluid outflow in alternating mode.

16. The expander system of claim 14 or 15, wherein the fluid control system includes a valve for controlling outflow of fluid from the inflatable fluid chamber.

17. The expander system of claim 16, wherein the valve is provided with electric control means arranged to control the valve.

18. The expander system of claim 17, wherein the electric control means comprises an electric conductor extending through a conduit for the transfer of fluid to or from the inflatable fluid chamber.

19. The expander system of any one of claims 1-18, wherein the tubular element extends into a borehole formed in an earth formation.

20. A method of radially expanding a tubular element using the expander system of any one of claims 1-19, comprising the steps of:

a) arranging the expander within the tubular element;

b) moving the expander from the retracted mode to the expanded mode thereof so as to expand the tubular element;

c) moving the expander from the expanded mode to the retracted mode thereof;

d) allowing the expander to move axially through the tubular element by the action of an axial force exerted to the expander, until further movement is prevented by virtue of the expander being in the retracted mode and said contact section contacting the inner surface of the tubular element; and

e) repeating steps b)-d) until the expander has expanded the tubular element or a desired portion thereof, from the first diameter to the second diameter.

21. The expander system substantially as described hereinbefore with reference to the drawings.

22. The method substantially as described hereinbefore with reference to the drawings.

F:\OA\TS6336PCT